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AUTHOR Petrun, Craig J.; Belmore, Susan M.
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ABSTRACT

A study examined cognitive processing differences between metaphoric and literal sentences. Thirty-three undergraduate students listened to 96 test sentences (including 48 fillers) that expressed 1 meaning in either a novel or frozen metaphorical or literal form: "The old couch was in love with its new slipcover" (novel), "The old couch was at home in its new slipcover" (frozen), "The old couch looked good in its new slipcover" (literal). The subjects were instructed that their primary task was to comprehend the meaning of each sentence, and they were told that they would have to make a yes/no "meaningfulness" judgment for each sentence. As a secondary task, subjects were asked to press a key in response to a light presented 250 msec after the last word in each sentence, with the response times recorded. Following presentation of the sentences, the subjects were given a forced-choice recognition test in which they were to determine which of two metaphorical and literal versions of a sentence had been presented in the trials. Performance on the secondary procedure indicated that metaphors required greater attention for comprehension. Performance on the "meaningfulness" judgment task showed that the subjects comprehended the meaning of the four sentence types equally well. Finally, in a result possibly related to the increased attention required to comprehend figurative language, both novel and frozen metaphors were remembered significantly better than literal sentences. (HTH)

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The On-Line Processing of Figurative and Literal Language

Craig J. Petrun & Susan M. Belmore

University of Kentucky

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Address Correspondence to: Craig J. Petrun, Department of Psychology, University of Kentucky, Lexington, Ky. 40506.
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The On-Line Processing of Figurative and Literal Language

Investigating the possibility of the differential processing of metaphoric and literal sentences is important for our understanding of figurative language. The focus of the current study was to investigate the attentional demands involved in the understandingof figurative and literal language. What is currently known about these possible differences however, is limited since language like other cognitive operations is a continuous and dynamic process. For instance, most of the initial studies investigating the processing of figurative language have examined the results of this on-going process after it has been completed through the use of postperceptual tasks (e.g., memory and paraphrase tasks). In order to examine these on-line processing differences methods must be used which will allow us to tap into the continuous nature of the comprehension process. Previous studies on metaphor comprehension have also failed to distinguish between frozen and novel types of metaphors, the former being instances of novel metaphors which through repeated use have become a common part of everyday language. In additon, these previous studies have failed to examine the effect of frozen and novel metaphors on the comprehension process. The goal of the present study was to directly compare the on-line processing demands of novel and frozen metaphors with literal sentences and to examine

the consequences of such demands on memory performance.

Previously, several studies which have suggested that processing differences do exist between metaphoric and literal sentences have based their conclusions on memory measures of the comprehension process (Bock & Brewer, 1980; Franklin & DeHart, 1982; Harris, 1979; Harris, Lahey, & Marsalek, 1980). For instance, Harris et al (1980) investigated the idea that metaphors may be more difficult to process than literal sentences by disrupting the initial processing of the metaphors. Their interference technique consisted of having the subjects count the number of words in a sentence after it was presented. Their results suggested that metaphoric and literal sentences were remembered equally well, even under what they termed a situation which placed added attentional demands on the subject. Although results such as these are interesting, one cannot conclude from them that the lack of memory differences reflected an absence of processing differences as this lack of a difference may only reflect the end or conscious aspects of sentence processing.

Recently, several researchers have begun to use processing time measures of figurative language comprehension (Glucksberg, Dial, & Bookin, 1982; Kemper, 1981; Petrun & Belmore, 1981; Pollio, Fabruzi, & Weddle, 1982). For example, Glucksberg et al (1982) used a version of the Stroop color-word interference technique to test the stage model of metaphor processing. Their results indicated

that when a figurative meaning was available for a sentence it took significantly longer to make a judgment about its literal meaningfulness. In another approach to examining the processing of figurative language Pollio et al (1982) investigated the amount of pausing which occured before the production of novel, frozen, and literal utterances in a spontaneous situation. They found no significant differences in the frequency or length of pauses which preceded either of the three sentence types. Results such as these suggest that people may access the meaning of nonliteral sentences automatically and that metaphors may be processed in a manner similar to literal sentences.

Although the results of the above studies suggest that figurative language does not involve a more complex or lengthy comprehension process than literal language, previous methodologies have not been sensitive to the possible on-line processing differences which may exist in the comprehension process. For instance, although metaphors may take no longer to comprehend than literal sentences they may differ in the amount of mental effort or cognitive capacity required for their processing. For example, Petrun and Belmore (1981) used a secondary task technique to compare the on-line processing demands of metaphorical and literal versions of the same sentence. Their results showed that more attention was required for the processing of metaphors and that when a sentence was presented metaphorically it was remembered better. They suggested

that different amounts of processing may be involved in the processing of literal and figurative language and that differences in memory performance were related to the amount of effort expended during comprehension.

The concept of measuring mental effort or attention is based on the assumption that humans possess a central processor which has a limited capacity and that two signals which require processing will compete with each other due to the limits of the central processor (Kahneman, 1973). A task which has been frequently used to measure the amount of attention being expended during sentence processing is the secondary task procedure. The logic of this task rests on the assumption that when greater effort is required by a primary task less attention will be available for the processing of a secondary task. Thus, the emphasis is on the effect of the primary task on the secondary task.

The current study was designed to examine the on-line processing differences between metaphoric and literal sentences. A secondary task procedure was used to measure the amount of attention required during sentence processing. The verification of the meaningfulness of each sentence was the primary task and response to an intermittent visual signal was the secondary task. Thus, the purposes of this study were to: 1) directly compare the processing demands of frozen and novel metaphors with nonmetaphors 2) examine the consequences of such demands on memory performance, and 3) compare the results of the current study with those of

Petrun and Belmore (1981).

Methods

The subjects were 33 undergraduate psychology students who received course credit for their participation in the study.

Procedure

The experimental stimuli consisted of 48 three sentence sets constructed by Harris (1976) which expressed one meaning in either a novel or frozen metaphorical or literal form. For example, "The old couch was in love with its new slipcover" (novel), "The old couch was at home in its new slipcover" (frozen), "The old couch looked good in its new slipcover" (literal). In addition 48 filler sentences similar in length and syntactic structure to the experimental sentences were constructed. Two-thirds of the filler sentences were anomalous and one-third were literal sentences.

The subjects were presented a total of 96 test sentences in individual testing sessions. The sentences were presented binaurally through headphones. The subjects were instructed that their primary task was to comprehend the meaning of each sentence. In addition, to encourage complete comprehension the subjects were instructed that they would have to make a yes/no meaningfulness judgment for each sentence. On half of the trials, a light (secondary task) was presented 250 msec after the last word in each

sentence. Although the subjects were told to focus on the primary task of comprehending the sentence they were reminded to respond to the light as quickly as possible by pressing the key directly in front of them with their index finger. A digital timer was used to record the button press response latencies to the secondary probe on each trial. Sentence type (novel, frozen, literal) was counterbalanced across subjects for a given sentence.

Following presentation of the sentences, the subjects were given an unannounced forced choice recognition test in which each test pair consisted of the two metaphorical and literal version of a sentence. The subject's task was to indicate which version of that sentence had been presented earlier.

Results

Performance on the secondary task procedure indicated that metaphors required a greater amount of attention for their comprehension. The mean response latencies to the secondary task signal for the novel, frozen, and literal sentences were 461 msec, 427 msec, and 398 msec respectively. These differences were significant ($p<.01$). Post-hoc comparisons of the sentence means indicated that only the novel and literal sentences differed significantly (Duncans Multiple Range Test, alpha=.05). Performance on the primary (meaningfulness judgment) task showed that subjects comprehended the meaning of the four sentence types equally well (Error Rate = .03%). The recognition data also

showed that significant differences existed between the memory for metaboric and literal sentences ($p<.01$). Post hoc analyses of the recognition scores showed that both novel (90%) and frozen (88%) metaphors were recognized significantly more than literal sentences (75%) (Fishers' LSD Test, alpha=.05).

Discussion

The results of the current study showed that subjects' response latencies to the secondary task signal were significantly slower during the comprehension of novel metaphors than for literal sentences. This finding indicated that more attention was allocated for the comprehension of novel metaphors than for literal sentences. This suggested that whether the meaning of a sentence was presented in a figurative or literal form significantly affected the amount of processing which was required during the comprehension process. The results of the recognition test demonstrated that both novel and frozen metaphors were remembered significantly better than literal sentences. This indicated that the meaning of a sentence was remembered better when it was conveyed figuratively and that recognition accuracy was associated with the amount of attention expended during comprehension. Thus, the results of the present study suggested that figurative and literal language may require different amounts of processing for their comprehension.

In addition to descriptive differences between novel

metaphors and literal sentences, the present results indicated that differences also occure during the processing of novel and frozen metaphors. The amount of effort required for the processing of frozen metaphors fell in-between the amount required for the understanding of the novel and literal sentences. The finding was in the expected direction since by definition frozen metaphors are described as having one accepted meaning in a manner similar to that of a literal sentence. This suggests that the frequently used distinction between novel and frozen metaphors not only has descriptive value but also has implications for the manner in which they are processed. The memory data however, indicated that although frozen metaphors required less attention, they were remembered just as well as the novel metaphors. This suggests that frozen metaphors might represent the optimal form of conveying information since they not only required less effort but were remembered just as well as the novel sentences. Further research into the possible differences between novel and frozen metaphors needs to be carried out however, before a more definitive conclusion about this idea can be reached.

The results obtained in this study also have implications for theorists that are concerned with the processes involved in the comprehension of figurative and literal language. For instance, several researchers (Glucksberg et al, 1982; Pollio et al, 1982) have suggested that metaphors may be processed automatically and in a

manner similar to that of literal sentences. Although the results of the present study do not address themselves to this issue directly, they indicate that the understanding of figurative language does place additional demands on the subjects' cognitive system which were reflected in a greater expenditure of attention during comprehension.

Finally, the current results support the previous findings of Petrun and Belmore (1981) with regard to the processing demands involved in the comprehension of figurative language. In both studies, novel metaphors were found to require significantly more attention for their comprehension than literal sentences.Although the reasons behind the initial processing differences have not been isolated, one possible explanation for the memory differences may be related to the increased attentional demands of the metaphors. For example, previous researchers (Eysenck & Eysenck, 1979; Tyler, Hertel, McCallum, & Ellis, 1979) have found that the amount of effort expended during comprehension was significantly related to later memory performance.

In conclusion, it appears that whatever mechanisms may be involved in the comprehension of figurative language these mechanisms require a greater allotment of attention by the subject and may lead to increased memorability when compared to literal sentences. These data argue against a view of language processing which considers the processing of literal and figurative language to be identical. In the

future, further investigatiors into the on-line processing of figurative language will aid in the discovery of the nature of the mechanisms involved in the comprehension of figurative language.

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